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STAFF PAPER

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EXPECTATIONS OF CATTLE FEEDING INVESTORS IN FEEDER CATTLE PLACEMENTS

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EXPECTATIONS OF CATTLE FEEDING INVESTORS IN FEEDER CATTLE PLACEMENTS

Abstract

Cattle feeders appear irrational when they place cattle on feed when projected profits are negative. Long futures positions appear to offer superior returns to cattle feeding investment. Cattle feeder behavior suggests that they believe a downward bias in live cattle futures persists and that cattle feeders use different information than the live cattle futures market price when making placement decisions. This paper examines feeder cattle placement determinants and compares performance of expected hedgeable profits with past actual profits in explaining feeder cattle placements. Past actual profits are found to be more important placement determinants than expected profits based upon the live cattle futures market, even though hedgeable profits provide superior forecasts of future profits.

EXPECTATIONS OF CATTLE FEEDING INVESTORS IN FEEDER CATTLE PLACEMENTS

Cattle feeders continue to place cattle on feed when expected feeding profitability (as signaled by the live cattle futures price) is negative. Purcell (1992b) reported that most respondents to a 1991 cattle feeder survey indicated that less than 10% of the time that they place cattle on feed, could a live cattle hedge cover variable costs. This suggests that cattle feeders who are placing cattle must expect an increase in live cattle futures price. If they believe this, it follows that they must believe a downward bias in the live cattle futures market persists. If investors perceive a downward bias, that would help explain their infrequent use of futures as a short hedge at time of placement. What it does not explain is why these same investors do not simply take long futures positions rather than own cattle.

This study addresses several related issues in an attempt to explain feeder cattle placements. The overtones of the above scenario are troublesome because they suggest that if cattle feeders are consistently correct in their assumption that live cattle futures prices will increase, then the futures market is inefficient and in particular biased. In addition, if cattle feeders are rational in their behavior to place cattle despite futures market projected losses, because a downward bias is thought to be present, then why do they not simply take a long position in live cattle futures instead? Perhaps cattle feeders use some other expectation of profitability other than the futures market, such as past profits. That is, perhaps cattle feeders do not use live cattle futures prices as their primary source of cattle feeding profit expectation. Lee and Brorsen concluded that feeder cattle prices tend to be biased upward when cattle coming off feed are earning profits. This suggests that past profits are important determinants of current feeder cattle demand. To address these issues we examine cattle feeder placement behavior and investigate performance of the live cattle futures market.

The objective of this study is to determine what factors impact feeder cattle placements. In particular, we determine whether cattle feeders' placement decisions are more strongly influenced by expected profit based upon the live cattle futures market, or upon past profit. We also investigate whether live cattle futures have tended to move in a particular direction over the feeding period as a possible explanation of observed cattle feeder behavior (i.e., why cattle feeders continue to buy and place feeder cattle when facing expected hedgeable losses).

Previous Literature

Two general areas of research are pertinent. The first is producer expectations and the role of futures markets in these expectations. The second related research deals with futures market efficiency. If cattle feeders place cattle despite facing large expected losses (as signaled via live cattle futures prices), then we must consider as explanations, whether their expectations are formulated using the live cattle futures market and/or whether biases in the live cattle futures markets are anticipated.

Several studies have used futures prices as producer price expectations (Gardner; Helmberger and Akinyosoye; Hurt and Garcia). In addition, Eales et al. determined that soybean and corn futures prices were consistent with mean price expectations of a sample of Illinois grain producers and merchandisers. Therefore, precedence exists to consider futures prices as expected prices.

However, livestock futures markets provide poor distant price forecasts (Garcia et al. 1988b; Just and Rausser; Leuthold and Hartmann; Martin and Garcia; Shonkwiler).[1] Garcia et al. (1988a)

[1] The term "poor" refers to relatively large forecast mean squared errors (e.g., Just and Rausser found forecast root mean squared percentage errors of 22 percent and 27 percent for four quarter-ahead live cattle and live hog futures prices, respectively compared to typically less than 15 percent for grains). Garcia et al. (1988b) however, were unable to find a trading strategy to profit from "poor" distant forecast performance of live cattle futures. Thus, this inaccuracy is not necessarily evidence of inefficiency.

concluded that based upon previous studies, livestock futures markets were more likely to be found inefficient than grain futures. Koontz et al. argued that one should not expect distant live cattle futures prices to be good forecasts of future prices. During the time that supply of cattle placed on feed can be altered, production decisions can cause the forecast to be inaccurate. High prices stimulate increased placements, which cause expected delivery date prices to fall. "The futures market will not forecast if doing so elicits behavior that will prove the forecast wrong" (Koontz et al., p. 235).

These studies bring into question the extent to which cattle feeders use live cattle futures for decisions to place cattle on feed. That is, if live cattle futures provide relatively poor distant forecasts, what information does the futures price provide cattle feeders in making placement decisions? This raises the issue of futures market efficiency. If the futures market is efficient, then it contains all relevant information that is available (Fama) and cattle feeders could use live cattle futures as their "best" available price forecast (even though it may not be highly accurate in the long run).

Futures market efficiency has been debated in the literature enough to merit a study of the studies (Garcia et al. 1988a). Several studies have generally supported livestock futures market efficiency (e.g., Kolb and Gay; Garcia et al. 1988b). Others found the market inefficient at times (Helmuth (this study has been subject to criticism - see Palme and Graham); Koppenhaver; Pluhar et al.). Elam and Wayoopagtr suggested that the live cattle futures market may have become more efficient in recent years. However, some inefficiency may be inherent within the cattle futures markets (Koontz et al.).

Overall, previous studies have mixed results regarding live cattle futures market efficiency. Although there are no general tendencies that completely reject efficiency of the market, there are studies that found at least time periods when live cattle futures have been suspected of being biased.

Of course, these results may reflect what seasoned futures traders generally recognize, that if mechanical rules are appropriately modified, large in-sample paper profits can be extracted from historical databases. If this is the case, an *ex post* downward bias in the futures markets may be easily uncovered. Nonetheless, these mixed results leave no resolution regarding whether cattle feeders garner significant information relevant to placement decisions from deferred live cattle futures prices.

Model of Feeder Cattle Placements

Assume cattle feeders maximize expected utility of profits subject to constraints imposed by their marketing and production environment. These constraints include the character of production costs and fed cattle prices. Maximizing expected utility of profits yields a demand for feeder cattle to be placed on feed. At any point in time cattle feeders choose to either place cattle in feedyards, or to leave them in growing or backgrounding phases. The decision to place cattle on feed today will be related to expected profitability of placing them. Timing of placement, although biologically constrained to some extent, has flexibility because there exists a range over which feeder cattle can be (and typically are) placed on feed.

This leads to a demand for feeder cattle to be placed on feed that can be specified as:

$$(1) \quad PLACEMENTS_t = f(E\pi_t, X_t)$$

where t refers to placement week, $PLACEMENTS_t$ are the number of feeder cattle placed on feed during week t, $E\pi_t$ is the expected profit associated with placing cattle in week t (\$/head), and X_t includes other relevant explanatory variables.

Equation (1) serves as the basis for modeling feeder cattle placement demand. Of interest is what measure(s) of expected profitability do cattle feeders use in their placement decisions? In particular, do cattle feeders use expected profits based upon futures markets as their expectation, or do they use a naive expectation of most recent profits (as in the cobweb model)? An empirical model was developed to determine whether cattle feeders' placement decisions are affected by expected profits based upon the live cattle futures market and projected cost of gain, or by a naive expectation of profits based upon actual recent cattle finishing profitability. If they base placement decisions on expected profits signaled by live cattle futures, then one wonders why cattle feeders often place cattle (bidding the price of feeder cattle up relative to fed cattle futures) despite large projected losses. Again, taking a long futures position would seem to make more sense. If on the other hand, placement decisions are based upon naive profit expectations, then cattle feeders are not using the futures market as an information source relevant to weekly cattle placement decisions.

Cattle placement decisions may be limited by cattle availability. In addition, it may take time to locate cattle for purchase or for feedyard space to become available. Therefore, it is unlikely that cattle feeders can react instantaneously to changing expected profit conditions. Nerlove proposed the partial adjustment model which allows for divergence between actual and desired changes in output (in this case feeder cattle demand). We use Nerlove's partial adjustment formulation to examine different profit expectations in the following models explaining feeder cattle placements:

$$(2a)\quad PLACEMENTS_t = \alpha_0 + \alpha_1 PLACEMENTS_{t-1} + \alpha_2 EH\pi_t^{t+19} + \alpha_3 TREND_t + \alpha_{j+3} MONTH_j + \varepsilon_t$$

$$(2b)\quad PLACEMENTS_t = \gamma_0 + \gamma_1 PLACEMENTS_{t-1} + \gamma_2 \pi_{t-19}^{t} + \gamma_3 TREND_t + \gamma_{j+3} MONTH_j + \varepsilon_t$$

$$(2c)\quad PLACEMENTS_t = \beta_0 + \beta_1 PLACEMENTS_{t-1} + \beta_2 EH\pi_t^{t+19} + \beta_3 \pi_{t-19}^{t} + \beta_4 TREND_t + \beta_{j+4} MONTH_j + \varepsilon_t$$

where $EH\pi_t^{t+19}$ is a measure of the expected hedgeable profits ($/head) associated with placing cattle in week t finishing in week t+19 (19-week typical feeding period), π_{t-19}^{t} is a measure of the actual profit ($/head) received for cattle placed in week t-19 and finished in week t (both profit measures are defined more explicitly in the data section), $TREND_t$ is a trend variable that increases by one with each weekly observation, $MONTH_j$ j=1,..,11 are monthly dummy variables, the α's, γ's, and β's are parameters to be estimated, ε_t's are random errors with zero means, and other variables are as defined previously. Since cattle number cycles may be quite lengthy (5-10 years), possibly encompassing the sample period, a trend variable is included.[2] Monthly dummy variables are included to capture seasonality.

Equations (2a) and (2b) are reduced models of equation (2c) and are estimated to determine the individual explanatory power of each expected hedgeable and recent actual profits in explaining feeder cattle placement demand. Equation (2c) enables us to test which of expected hedgeable or recent actual profits is a more important placement determinant. If β_2 is significant this suggests cattle feeders use expected hedgeable profits as a guide in placement decisions. Significance of β_3 indicates cattle feeders use recent actual profits in making placement decisions. This could also reflect a wealth effect, implying cattle feeders bid up feeder cattle prices when recent cattle feeding has been profitable, as Lee and Brorsen suggested.

After examining the two possible investors' measures of expected profitability, of further interest is which of the two more accurately forecasts actual profitability. That is, if one or the other (expected hedgeable profits or recent actual profits) is a superior forecaster of sale date profits on the placement date, then the superior information should be used in making placement decisions. To test this, the following empirical models are estimated:

[2] Primary implications of results of the model estimation reported later were insensitive to whether either lagged placements or the trend variable were included.

(3a) $\pi_t^{t+19} = \alpha_0 + \alpha_1 EH\pi_t^{t+19} + \varepsilon_t$

(3b) $\pi_t^{t+19} = \gamma_0 + \gamma_1 \pi_{t-19}^{t} + \varepsilon_t$

(3c) $\pi_t^{t+19} = \beta_0 + \beta_1 EH\pi_t^{t+19} + \beta_3 \pi_{t-19}^{t} + \varepsilon_t$

where the variables are as defined previously, with subscripts denoting placement week, and superscripts denoting slaughter week.

Equations (3a) and (3b) are reduced models of equation (3c) and are estimated to determine the forecasting ability of each expected hedgeable and recent actual profits. Out-of-sample forecasting performances of the three models are used to determine which sources of information are most useful in generating profit expectations. Information important in forecasting profits is expected to be significant in guiding feeder cattle placements.

Data

Weekly 7-state feeder cattle placements were collected from Cattle-Fax.[3] Weekly *projected* and *actual* profitability of feeding cattle were calculated using closeouts from February 2, 1987 through May 17, 1993 (329 weeks), obtained from Southwest Stockman, Amarillo, Texas. Each week a telephone survey was conducted of a sample of participating feedyards within a 70-mile radius of Amarillo. Projected cost of gain (ECOG) for steers placed on feed that week, actual cost of gain (ACOG) on steers closed out that week, and average selling price (SP) of cattle closed out were reported.

[3] According to Cattle-Fax, their placement numbers have typically represented roughly one-third of the monthly USDA 7-state numbers. The weekly Cattle-Fax placement numbers aggregated to monthly totals had a correlation of 0.90 with monthly USDA 7-state placements over 1987-1992.

In addition to the survey data, the following data were employed. Weekly averages of USDA-reported direct trade prices of 600 to 700 pound Medium and Large Frame steers in the Texas-Panhandle area were used as the weekly feeder steer purchase price (PP). Placement week futures prices (average of Monday through Friday closes) for the pertinent deferred live cattle futures contracts were used as the hedge prices (HP). An historical 4-year moving average of actual delivery week bases (cash price less nearby futures) was constructed from Cattle-Fax Texas Panhandle bases figures and used as the estimates of expected basis (EB). Steers were assumed to be purchased at 650 pounds (PW), and slaughtered at 1100 pounds (SW) 19 weeks after placement.[4] Interest rates of New York prime plus 1.5 percentage points were used to calculate interest cost (IC).[5] Interest was assumed to accrue for 5 months on the purchase cost of the feeder and one-half of the feeding cost. Thus, both expected hedgeable and actual profits are economic profits, inclusive of opportunity costs. Expected hedgeable ($EH\pi$) and actual (π) profits are defined here as:

$$EH\pi = (HP + EB)*SW - PP*PW - ECOG*(SW - PW) - IC \tag{4a}$$

$$\pi = SP*SW - PP*PW - ACOG*(SW - PW) - IC \tag{4b}$$

These data allowed calculation of both breakeven projections for cattle currently being placed on feed, as well as estimates of actual performance of current closeouts. Thus, *expected* and *actual* performance can easily be compared.

Table 1 contains summary statistics of the data. Notice that in spite of projecting average weekly hedge *losses* of \$25/head, unhedged cattle acquired actual *profits* in the range of \$15/head. As expected, hedgeable profits have a considerably smaller range, as well as a standard deviation almost

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[4] Prior to selling date of 10/15/90, the Southwest Stockman assumed a 1050-pound finish weight.

[5] A personal telephone conversation with a loan officer in the Amarillo area confirmed that this is a reasonable rate for cattle feeding loans.

one third that of cash profits (Koontz et al.). Weekly feeder cattle placements averaged 147,480 head and exhibited wide variability with a range larger than the mean. Figure 1 shows the weekly variation in feeder cattle placements from February 1987 through May 1993.

Results and Discussion

To determine what form of profit expectations cattle feeders use in making placement decisions equations (2a) through (2c) were estimated using estimated generalized least squares (EGLS) allowing for first order autocorrelation of the residuals. The estimates are presented in table 2. The models explained 64% to 65% of the variability in weekly placements. All coefficients had the expected signs. Recent actual profits were positive and significantly different from zero (0.01 level) in estimates of both equations (2b) and (2c). However, expected hedgeable profits were not significant at the 0.10 level in either equation (2a) or (2c).[6]

Several monthly dummy variables were significant, reflecting seasonal cattle placements. In addition, the coefficient on TREND depicted a significant decrease in feeder cattle placements over the sample period, consistent with trends in cattle numbers.

Since the models portrayed in equations (2a) through (2c) are partial adjustment models, we are able to examine short run and long run responses of cattle placements associated with profitability changes. Using estimates from equation (2c), a 1% increase in recent cattle feeding profits increases placements 0.0075% in the short run and 0.015% in the long run (at the means). One-half of the total response is completed in 0.98 weeks. Because expected hedgeable profits was not significantly different from zero, its elasticity was not calculated.

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[6] Collinearity between expected hedgeable and actual lagged profits is not a problem in comparing parameters of these two variables, as the simple correlation between these two variables was only 0.015.

The implication of these results is that cattle feeders used recent actual profits as a significant information source for feeder cattle placement decisions, but did not use expected hedgeable profits to guide placement decisions. The results suggest that either a wealth effect of recent profits impacts feeder cattle prices, and/or cattle feeders use naive profit expectations when placing feeder cattle. If cattle feeding profit could be projected at feeder placement more accurately using profit on cattle just closed out rather than by using expected future profit based upon the live cattle futures market, then this behavior would still appear rational. To test whether this was the case equations (3a) through (3c) were estimated using OLS, and their out-of-sample forecasting ability for projecting actual profits were then compared. If expected hedgeable profits have superior forecasting accuracy relative to lagged actual profits, then cattle feeders should be using this information in making placement decisions.

The ability of (3a) through (3c) to forecast actual profitability was formally compared in the following manner. Each equation was estimated with OLS over all available observations in 1987 (closeout dates June 15, 1987 through December 28, 1987, 29 weeks).[7] These competing models were used to forecast the actual profits one feeding period ahead (19 weeks into the future). For each succeeding period, the forecasting models were reestimated adding one more week to the data. Forecasts were thus calculated using each of the models, covering a forecasted period of May 16, 1988 through May 17, 1993, for a total of 262 out-of-sample 19-week-ahead forecasts.

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[7] First order autocorrelation was present in the three estimated equations. It was not corrected for because it would not be helpful for forecasting 19 weeks into the future (19 steps ahead). The information content of the lagged residual declines exponentially as one forecasts additional steps ahead.

The final models estimated, which include data for cattle placed through January 4, 1993, are reported in table 3.[8] Both lagged actual and futures hedgeable profits are statistically significant in explaining actual profitability in all three models. The two profit parameter estimates in (3c) are each highly significant (0.01 level). This suggests that the full model (3c) is statistically superior to either of the reduced models (3a) or (3b) and both lagged actual and expected hedgeable profits are important in explaining actual profits.

Out-of-sample forecasting performance of the three models is presented in table 4. The forecast Root Mean Square Error (RMSE) of the hedgeable profits model (3a) was $50.18/head, and the forecast RMSE of the lagged actual profits model (3b) was $51.78/head. The forecast RMSE of the model including both lagged actual and expected hedgeable profits (3c) was lowest of the three at $49.76/head.

A statistical comparison of the mean squared forecast errors of the three models was performed using the Ashley, Granger, and Schmalensee (AGS) procedure (table 4). This procedure is described by Bradshaw and Orden; and by Goodwin. The hedgeable profits model (3a) provided a significantly more accurate forecast (0.067 level) of actual profits than did the lagged actual profits model (3b). Thus, if cattle feeders used only one source of profit information to guide placements, expected hedgeable profits would be more useful than recent actual profits (which results presented earlier suggest they use). Equation (3c) had a significantly lower (0.033 level) out-of-sample forecast RMSE than the recent actual profits equation (3b), and a marginally significantly lower (0.155 level) forecast RMSE than the hedgeable profit model (3a). This indicates that expected hedgeable, and to some extent recent actual profits, provide useful information for forecasting cattle feeding profits 19 weeks into the future.

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[8] Our data set covers cattle placed through May 17, 1993. Actual profits for cattle placed on feed after January 4, 1993 would become available after May 17, 1993, which is beyond our data period. Therefore, the models in table 3 only include cattle placed through January 4, 1993.

Cattle feeders could make more informed decisions by using expected hedgeable profits as a guide in placement decisions. This raises the question of why cattle feeders do not appear to use this information. As stated earlier, cattle feeders may suspect that the live cattle futures market is biased downward and previous research is mixed on this. We calculated the average live cattle futures price movements over 19-week feeding periods for each week during 1977 through May 1993 (table 5). Positive average price movements indicate that the futures contract prices increased on average during the 19-week periods, negative values indicate price declines. Only 5 years exhibited average price declines whereas 12 years show average price increases. During the 1987-93 period, corresponding to the period used to estimate equations (2a)-(2c), live cattle futures prices increased on average between feeder placement and slaughter every year except 1991. The overall average price move across all years was $1.73/cwt. Is this the reason cattle feeders have not used expected hedgeable profits for placement decisions in recent years? That is, do they expect such price movement to occur? If so, cattle feeders taking long live cattle futures positions seems logical.

An obvious potential remover of downward bias should be cattle feeding investors. Investors, by purchasing cattle when a negative expected hedgeable profit exists, are making a strong statement that they believe live cattle futures will move upward. This *has* to happen for them to make a profit feeding cattle. Why is the group whose actions imply they believe strongly that the futures market will move upward, not trading that market? A 1984 Cattle-Fax study reported that up to 80% of cattle on feed in major cattle feeding areas of the Great Plains were owned by outside investors (Schroeder and Blair).[9] The quantity of potential players is large, as well as the number of time periods when it would appear rational for cattle feeding investors to trade futures and remove a bias. If it is true, that one can cover variable costs with a hedge at placement only 10% of the time, as

[9] Recent conversations with Kansas feedyard operators, as well as a banker in Amarillo, indicate that typically 60-70% of the cattle on feed in these areas are custom fed (i.e., investor owned), declining to 40-50% following periods of sustained cattle feeding losses.

cattle feeders reported in Purcell's (1992b) survey, this implies that 90% of the time cattle feeding investors may be better off with long futures positions rather than owning cattle in feedyards. Investors feeding cattle during times of negative expected hedgeable profits is somewhat of a paradox.[10]

Purcell (1992a) argued that feedyard operators should recognize unusually negative expected feeding margins, defined as *expected* selling price (futures plus basis) less expected *variable* costs. When these margins are abnormally negative, feedyard operators would be expected to go long the distant live cattle futures, while simultaneously shorting the nearby feeder cattle futures, and remain so until feeding margins were "back in line". However, results of Purcell's (1992b) survey of feedyard operators indicate that they do not normally respond to negative feeding margins by becoming involved in futures markets.

Purcell (1992a) argued further that the Internal Revenue System's (IRS) asymmetric treatment of capital gains and losses is one possible explanation of feedyards' non-use of the futures market to offset negative feeding margins. The same argument would hold for cattle feeding investors. The IRS views long futures positions held by investors as speculation rather than hedging. Hedging incurs *normal* gains and losses, whereas speculative trading incurs *capital* gains and losses. Net capital gains are taxable in the current year. Net capital losses, for the most part, must be used to offset past or future net capital gains (Warach, pp. 240, 680). This difference in the "time value" of the incurred

[10] Koontz et al. and Purcell (1992a) suggest that USDA-reported feeding costs are higher than industry averages. This explains finding long periods when one could not hedge a profit at placement. But this is not merely a data problem. Purcell's survey suggests that the industry *believes* there is only a small percentage of time that profitable hedging opportunities coincide with placements.

taxes means that a trader has to "see" a larger potential profit before going after it, implying that a bias has to be greater before it is traded out than it would be without asymmetric IRS treatment.[11]

A second IRS implication for cattle feeding investment is that feed bills, if paid, are often deducted during the current year on a pen of cattle that is not slaughtered until the following year (O'Byrne and Davenport p. 156). The amount that this tax savings compounds into the following would be an indication of this incentive to actually own cattle. A third IRS implication is that cattle feeding investment is normally considered a passive activity, and as such, net passive activity cattle feeding losses can only be offset by other passive activity gains, or otherwise carried forward. This would be a disincentive to cattle ownership. While it would be difficult to assess the passive/capital nature of a given investor's portfolio outside of cattle feeding, it may be reasonable to assume that the capitalization-of-losses disincentive to trading futures may offset the passive-activity disincentive to cattle feeding, leaving the current-year-feed-cost-deduction as possibly the net effect of the IRS implications.[12]

Investors owning cattle during negative expected profit scenarios may prefer a game that has at least low probability of high profit, implying cattle feeding is comparable to purchasing a lottery ticket. But profitability is sensitive to fed cattle price changes, so why is an investor's penchant for risk not sated by involvement in a long futures position, which would provide most of a cattle feeding venture's unusually large profits?

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[11] A simulation of this "time-value" distortion showed that a long speculative trader, trading each of the 19-week moves shown in table 5, would have made \$0.15/cwt. less after-tax profit per trade than a long hedger. The time value of money used was 12.22% (1.5% above prime), and the income tax rate was the current top corporate rate of 34%. This is a small disincentive relative to the incentive of \$1.73/cwt reported in table 5.

[12] This effect could be small, since it applies to the *interest* earned on deferred taxes only on those cattle placed in one year and sold in the next. A simulation at the means assuming a 34% tax bracket, would imply an incentive to feeding cattle over trading futures of \$0.12/cwt.

Investors may simply not be knowledgeable about the futures market. They may not consider a long position in the futures a substitute for cattle ownership. This is plausible when one considers that the party that should possess the best knowledge of the relationship between futures prices and projected breakevens, the feedyard operator, has the most to lose by disseminating that information. The feedyard manager could end up with empty pens as a reward for providing this information to cattle feeding investors. Few customer-fed cattle are actually hedged (Purcell 1992b), which may be because customers and feedyard operators perceive a downward bias in the futures market, and not because they do not understand the futures market. Most feedyards explicitly offer hedging services to their customers (Schroeder and Blair). If the technique of short-hedging is explained to the feedyard's customers, the customers' understandings of that technique should imply their understandings of the long side of the futures market as well.

Conclusion

Cattle feeding investors use naive profit expectations to make placement decisions. Recent actual profits were more important than hedgeable profits at placement in explaining weekly feeder cattle placements, despite hedgeable profits offering superior forecast information. If cattle feeding investors understand the live cattle futures market, the fact that they place cattle on feed when a futures hedge is offering negative profits is an indication that they must believe that the futures market is biased downward. That is, their behavior suggests that during these times they expect futures prices to rise between placement and slaughter.

During the past few years live cattle futures prices have shown a tendency to increase over the typical feeding period. Thus, cattle feeding investors, by remaining in the cash market, have not realized the large losses that were often projected by hedging opportunities at placement. However, still unresolved from this investigation is why cattle feeders bid up feeder cattle prices so that cattle placed face dismal projected losses, or why in these situations cattle investors do not take long live cattle futures positions. Several factors including tax implications and knowledge of the futures market have arisen as possible explanations of such behavior, however, at first glance none of these appear to be sufficient to justify the behavior. Several fascinating questions arise from this study regarding cattle feeding investor behavior that would benefit from future research.

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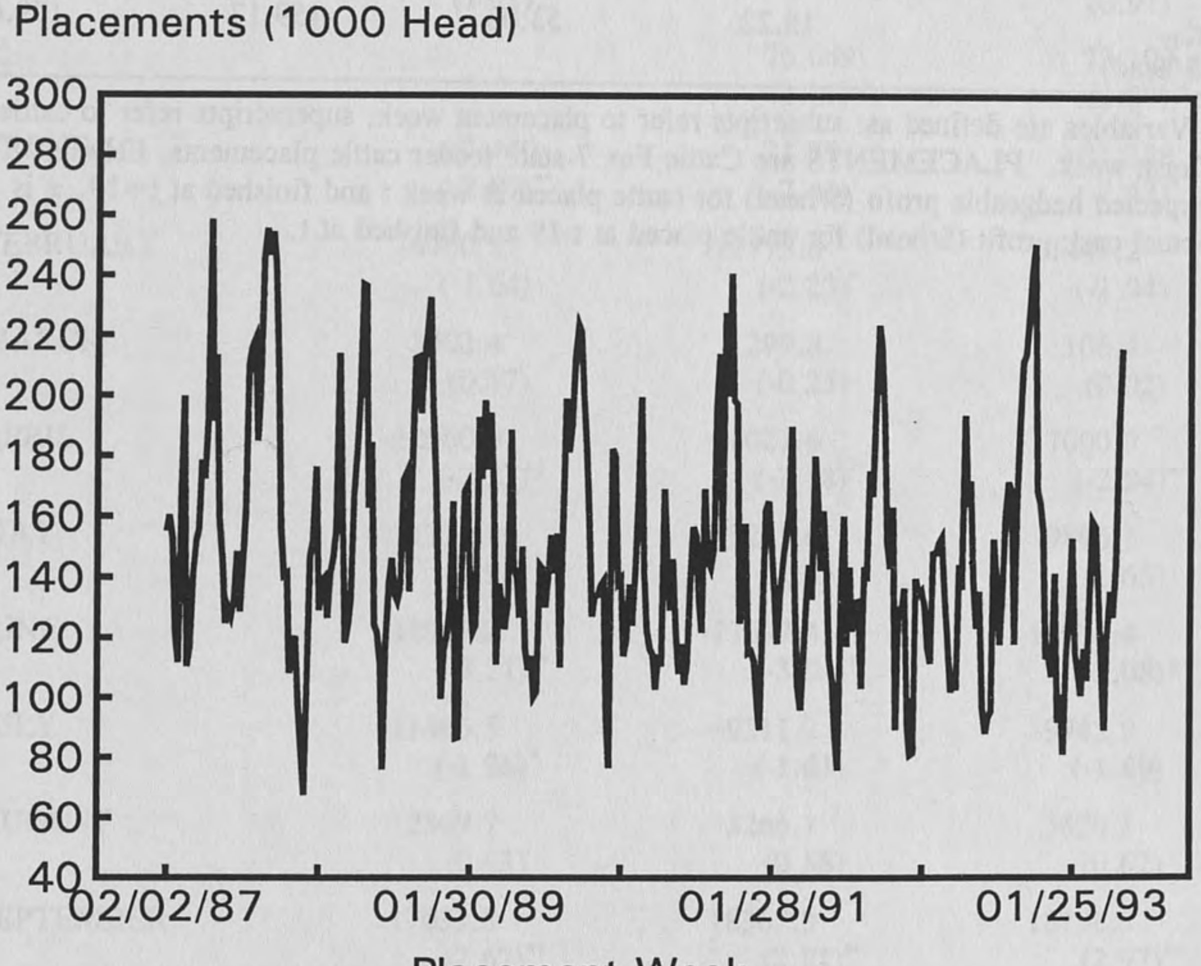

Figure 1. Weekly Cattle-Fax Feeder Cattle Placements, February 2, 1987 through May 17, 1993.

Table 1. Summary Statistics of Weekly Data for Cattle Placed on Feed February 2, 1987 through May 17, 1993.

Variable[a]	Mean	Std. Dev.	Minimum	Maximum
Placements	147480	38648	67579	258611
$EH\pi_t^{t+19}$ ($/head)	-25.22	19.13	-64.12	37.59
π_{t-19}^{t} ($/head)	15.22	53.03	-159.17	159.67

[a] Variables are defined as: subscripts refer to placement week, superscripts refer to cattle finish week, PLACEMENTS are Cattle Fax 7-state feeder cattle placements, $EH\pi$ is expected hedgeable profit ($/head) for cattle placed at week t and finished at t+19, π is actual cash profit ($/head) for cattle placed at t-19 and finished at t.

Table 2. Estimates of Factors Affecting Weekly Feeder Cattle Placements, February 2, 1987 through May 17, 1993.[a]

Variable	Equation (2a)	Equation (2b)	Equation (2c)
$PLACEMENTS_{t-1}$	0.520 (8.57)**	0.499 (8.20)**	0.496 (8.09)**
$EH\pi_t^{t+19}$	101.537 (1.41)		69.362 (0.97)
π_{t-19}^{t}		76.689 (3.05)**	73.109 (2.87)**
TREND	-37.440 (-2.87)**	-31.77 (-2.46)*	-31.388 (-2.43)*
FEBRUARY	-9760.8 (-1.64)	-12773.0 (-2.23)*	-11447.2 (-1.94)
MARCH	3402.4 (0.57)	-1299.8 (-0.23)	106.4 (0.02)
APRIL	-12960.0 (-2.27)*	-18027.6 (-3.18)**	-17000.9 (-2.94)**
MAY	11771.8 (1.94)	9221.6 (1.55)	9896.1 (1.65)
JUNE	-18957.2 (-3.21)**	-17697.4 (-3.04)**	-18001.4 (-3.08)**
JULY	-11466.5 (-1.96)*	-9211.2 (-1.61)	-9742.9 (-1.69)
AUGUST	2569.7 (0.43)	3266.7 (0.56)	3620.1 (0.62)
SEPTEMBER	17039.8 (2.67)**	18367.3 (2.91)**	18798.3 (2.97)**
OCTOBER	30868.0 (3.94)**	33199.3 (4.27)**	32862.9 (4.22)**
NOVEMBER	-17539.5 (-2.81)**	-16466.6 (-2.68)**	-16984.5 (-2.76)**
DECEMBER	-24741.3 (-4.10)**	-23325.0 (-3.97)**	-24133.9 (-4.05)**

Table 2. Continued.[a]

Variable	Equation (2a)	Equation (2b)	Equation (2c)
INTERCEPT	82653.2	81554.1	83512.5
	(8.13)**	(8.36)**	(8.31)**
ρ_{t-1}	-0.160	-0.165	-0.162
	(-2.11)*	(-2.18)*	(-2.13)*
R-Squared	0.64	0.65	0.65
Observations	328	328	328

[a] Dates refer to placement dates on feed. T-statistics are reported in parenthesis. Single asterisks indicate significantly different from zero (two-tailed test) at the 0.05 level. Double asterisks denote significance at the 0.01 level. Variables are defined as: subscripts refer to placement week, superscripts refer to cattle finish week, dependent variable is feeder cattle placements (head) in week t, finished in week t+19, EHπ is expected hedgeable profit ($/head) for cattle placed at week t and finished at t+19, π is actual cash profit ($/head) for cattle placed at t-19 and finished at t, TREND is linear time trend, each month is a binary variable equal to one in that month and zero otherwise, and ρ is the residual autocorrelation coefficient.

Table 3. Estimates of Hedgeable Profits and Lagged Actual Profits As a Forecast of Actual Cattle Feeding Profits, February 2, 1987 through January 4, 1993.[a]

Variable	Equation (3a)	Equation (3b)	Equation (3c)
$EH\pi_t^{t+19}$	1.051		1.025
	(7.88)**		(8.03)**
π_{t-19}^t		0.265	0.252
		(5.20)**	(5.41)**
INTERCEPT	35.357	6.519	31.852
	(8.55)**	(2.39)*	(7.94)**
R-Squared	0.17	0.08	0.24
Observations	310	310	310

[a] Dates refer to placement dates on feed. T-statistics are reported in parenthesis. Single asterisks indicate significantly different from zero (two-tailed test) at the 0.05 level. Double asterisks denote significance at the 0.01 level. Variables are defined as: subscripts refer to placement week, superscripts refer to cattle finish week, dependent variable is actual cash profit ($/head) for cattle placed in week t, finished in week t+19, $EH\pi$ is expected hedgeable profit ($/head) for cattle placed at week t and finished at t+19, π is actual cash profit ($/head) for cattle placed at t-19 and finished at t.

Table 4. Ashley-Granger-Schmalensee (AGS) Tests for Significance of Forecast MSE Differences.[a]

	Forecast Model		
	Hedgeable Profit Eqn. (3a)	Lagged Profit Eqn. (3b)	Both Profits Eqn. (3c)
Forecast Root Mean Squared Error	\$50.18/head	\$51.78/head	\$49.76/head
Alternative Forecast Model	Significance Level of AGS Statistic[b]		
Eqn. (3a)	---	---	0.155
Eqn. (3b)	0.067	---	0.033
Eqn. (3c)	---	---	---

[a] AGS tests are obtained from regressing $\Delta_t = \beta_0 + \beta_1 [E_t - \bar{E}_t] - e_t$ where Δ_t is the difference between forecast errors, E_t is the sum of the forecast errors, $\bar{E}_t$ is the sample mean of E_t, and e_t it a white noise residual.

[b] Significance levels are for the appropriate four-tailed F-test. Significance levels are relevant only when MSE of Alternative Forecast Model exceeds MSE of Forecast Model.

Table 5. Average 19-Week Movement in Weekly Live Cattle Futures Prices, 1977- May 1993.

Year	Weeks	Mean	Standard Deviation	Minimum	Maximum
		------------- ($/cwt) -------------			
1977	52	-0.62	3.05	-5.88	5.45
1978	52	6.29	5.18	-1.94	18.58
1979	53	4.25	7.26	-11.51	18.85
1980	52	-1.86	5.69	-14.42	12.52
1981	52	-3.98	4.18	-13.01	2.42
1982	52	1.74	5.94	-6.81	15.20
1983	52	2.32	4.47	-5.77	14.87
1984	53	2.41	3.91	-2.28	10.51
1985	52	-2.96	5.48	-13.02	9.58
1986	52	0.64	5.30	-8.56	12.22
1987	52	5.30	4.07	-4.62	13.16
1988	52	3.73	4.02	-4.55	11.51
1989	52	1.10	2.69	-5.09	6.45
1990	53	3.36	1.59	0.11	6.31
1991	52	-0.02	3.46	-7.18	6.46
1992	52	3.88	1.43	1.08	6.70
1993[a]	20	7.13	2.38	2.24	10.97
1977-93	855	1.73	5.30	-14.42	18.85

[a] Data ends May 17, 1993.

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